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U. S. ARMY TEST AND EVALUATION COMMAND
EXPANDED SERVICE TEST - SYSTEM TEST OPERATIONS PROCEDURES

AMSTE-RP-702-105

*Test Operations Procedure 6-3-097

21 September 1972

AD 756702

DEVICE, NIGHT OBSERVATION

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SECTION I
GENERAL

1. Purpose and Scope. This Test Operations Procedure (TOP) is written as a guide to assist in the preparation of a test plan for Expanded Service Test (EST) of a type night observation device. It describes methods and techniques to be used in determining if a candidate device meets the criteria established in applicable requirements documents and is suitable for use by the United States Army.

*This TOP supersedes MTP 3-3-097, 27 July 1970.

Approved for public release; distribution unlimited.

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The procedures which follow address (1) preoperational considerations and checks of test item characteristics, (2) tests of functional responses of the device to the operational requirements of tactical employment, and (3) an examination of human factors engineering and value analysis.

This TOP is designed to provide test methods for short, medium, or long range night observation devices of both active and passive modes of operation capabilities. It does not address searchlights, sights, radar, sound ranging, detecting sets, photographic surveillance systems, periscopes, range finders, or other items normally defined as aids to night operations, as opposed to the pure observation mission of the subject of these procedures.

The night environment is defined as full moon, 1×10^{-2} to 4×10^{-2} foot candles; half-moon, 1×10^{-3} to 4×10^{-3} foot candles; starlight, 1×10^{-4} to 4×10^{-4} foot candles; overcast, 1×10^{-5} to 4×10^{-5} foot candles; dawn and dusk, 1 to 10 foot candles; and twilight, 1×10^{-1} to 10 foot candles.

2. Background. Combat surveillance is a principal means by which enemy objects and activities are detected. It encompasses many techniques in accomplishing a continuous (all weather, day and night) systematic watch over the battle area to provide timely information for tactical operations.

Surveillance is characterized by line of sight limitations which, when combined with the darkness of night, require some kind of mechanical aid-to-vision device to assist the seeing process. The night observation devices envisioned in this document will aid in detecting and amplifying reflected, low light level, natural illumination; invisible radiation emitted by the target or background; or reflected invisible illumination provided by supplemental illumination. The devices will be used during darkness or other periods of limited visibility by forward elements (outposts, observation posts, forward observers, patrols, and surveillance units) of the Army in the field.

The expanded service test will determine the overall suitability of a candidate item for entry into the Army inventory, and the results of the test will provide a basis for recommending type classification.

3. Equipment and Facilities.

a. Equipment.

- (1) Test item, with training equipment and maintenance test package.
- (2) Control item, if applicable.

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- (3) Weighing equipment.
- (4) Linear measuring equipment.
- (5) Binoculars.
- (6) Vehicles, air and ground.
- (7) Photographic equipment.
- (8) Meteorological Instrumentation.
- (9) Communications equipment.
- (10) Photometer.
- (11) Safety and first aid equipment.
- (12) Infantry direct and indirect fire weapons.
- (13) Various visible and invisible light sources.
- (14) Ammunition.
- (15) An Infantry unit, complete with TOE weapons and equipment.
- (16) Other equipment prescribed in referenced MTP's/TOP's.

b. Facilities.

- (1) Field training areas of varied terrain.
- (2) Firing ranges and appropriate targets (instrumented, if available).
- (3) Classroom, office, and storage space.

SECTION II
TEST PROCEDURES

4. Supporting Tests.

- a. The procedures which follow will provide a test officer with the methodology required to service test a candidate night observation device.

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Although described in succeeding paragraphs, the subtests need not be conducted in the order of their listing, as some will overlap or be performed simultaneously with others. The subtests must be applied selectively according to the mission and criteria expressed for the test item, and specific procedures will depend upon the characteristics of the candidate item and the criteria and requirements stated in the applicable needs documents.

b. Data must be collected in sufficient quantities and be of a quality to support valid conclusions. This objective may be constrained by a limited quantity of test or control items, a limited time frame to accomplish the test, or limits of manpower, funds, or general support facilities. To identify the best means of securing meaningful data within the limitations imposed, the test officer should remain in close liaison with available statistical and human factors personnel. The statistician will contribute to the fixing of the overall experimental design or pattern, and the human factors representative will add his expertise to the development of questionnaires, interview techniques, and the human factors input of plans and reports. Additional statistical guidance in selecting sample sizes for desired confidence levels is contained in MTP/TOP 3-1-002, Confidence Intervals and Sample Sizes.

c. A log book should be kept as a chronological record of observations, remarks, meteorological data, times, comparisons, and other pertinent events and results as they occur. An orderly and accurate tabulation will expedite the collation process following each phase of testing. The results of testing will be presented in narrative form supplemented by tables, charts, graphs, photographs, and motion pictures, when appropriate.

d. Meteorological data, to include ambient light conditions, temperatures, precipitation, cloud formations, wind speeds, and moon phases will be closely monitored and recorded throughout the conduct of all subtests.

e. When possible, a control device will be used as a measurement of comparison in any appropriate test. The control device will be as closely related, characteristically, to the test item as is possible, and should be as new, or near new, as feasible. Throughout areas of comparison every effort must be made to afford equal conditions of test to the test and control items.

f. Common MTP's/TOP's, the tests defined in Section III, and other publications to be considered in formulating an EST are listed in the reference appendix and as follows:

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<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
(1) Preoperational Inspection and Physical Characteristics (refer to para 5)	6-3-501 and 6-3-500
(2) Personnel Training (refer to para 6)	6-3-502
(3) Safety (refer to para 7)	6-3-523
(4) Operational Suitability (refer to para 8)	
(5) Compatibility with Weapons Employment (refer to para 9)	
(6) Suitability of Power Supply (refer to para 10)	
(7) Portability/Transportability (refer to para 11)	
(8) Security From Detection (refer to para 12)	3-3-515
(9) Electronic and Light Interference (refer to para 13)	6-3-513
(10) Durability (refer to para 14)	6-3-506
(11) Reliability (refer to para 15)	6-2-503
(12) Maintainability (refer to para 16)	6-3-524
(13) Human Factors Engineering (refer to para 17)	6-3-525
(14) Value Analysis (refer to para 18)	

SECTION III
SUPPLEMENTARY INSTRUCTIONS

5. Preoperational Inspection and Physical Characteristics.

a. Perform the applicable procedures of MTP/TOP 6-3-500, Physical Characteristics, and MTP/TOP 6-3-501, Pretest Inspection for Service Test, to (1) verify the completeness of the test device, (2) compare the physical characteristics of the test item with those stated in the appropriate needs documents, and (3) determine that the test item is in operating condition and is suitable for testing.

b. MTP/TOP 6-3-500 outlines procedures to examine the size, weight, and configuration of a test item and compare the findings with the requirements prescribed in the applicable materiel needs documents associated with the item. The failure of an item to meet specified physical characteristics may of itself constitute the basis for determination that the device is unsuitable for Army use. Therefore, weights and measurements must be obtained with the precision and accuracy required to support such an important judgment should one become necessary.

c. MTP/TOP 6-3-501 will provide a test officer with methods for determining the condition of the test item when received at the test site. This phase will include full operation of the candidate device and may reveal errors, faults, needs for alignment or adjustments, and defective or missing parts. The possibility that such substandard conditions exist at the time of receipt must be closely examined and properly identified as pretest defects. Otherwise, a condition which in reality may have been a product of handling abuse or poor product control procedures during manufacturing could be attributed to a functional response to the tests which will follow. The findings of this subtest will also determine the suitability of the test device for further testing.

6. Personnel Training.

a. Apply the appropriate procedures of MTP/TOP 6-3-502, Personnel Training Requirements, to determine (1) the amount and type of training required for operators and crew or team members to become proficient in the tactical operation and operator maintenance of the test item, (2) whether the proposed program of instruction is adequate, and (3) whether the test item meets the training criteria as expressed in the appropriate needs documents.

b. Test soldiers should be selected as representative of the user population. Characteristically described in Military Standard 1472A, Human Engineering Design Criteria, they should represent the 5th through the 95th percentile in height, weight, and body configuration. Some should be left-handed and, in addition to those with normal vision, some should wear corrective eye glasses. Each should become familiar with:

- (1) The characteristics of the test and control items.
- (2) The conduct, procedures, and objectives of the EST.
- (3) Individual assignments and responsibilities.

c. It is essential that test participants become equally familiar with the test and control items in order to minimize bias during comparison tests. The performance of the test item must not be downgraded because of its newness or unfamiliarity. If personnel are familiar with the control item, emphasis must be placed on the test device training to promote a fair judgment.

d. In the event a training package accompanies the test device, its program of instruction and other contents will be evaluated during this and other subtests. If found inadequate, recommendations for change, modification, or improvement will be made a matter of record.

7. Safety.

a. Perform the applicable procedures of MTP/TOP 6-3-523, Safety, Electronic Equipment, to determine (1) the effectiveness of the test item's safety features, (2) if the specific safety requirements of the materiel needs documents have been met, and (3) whether the specific test items are safe for further testing.

b. During this phase the test officer must become thoroughly familiar with the safety data requirements of TECOM Regulation 385-6, Verification of Safety during Testing; with the safety release (or other safety limitations imposed by authority); and with local safety regulations and restrictions. When safety considerations, in the opinion of the test officer, do restrict or otherwise influence test plans or results, this factor will be properly reported.

c. Safety will be observed throughout the conduct of all subtests, and safety data will be continually accumulated, collated, and evaluated in accordance with the provisions of TECOM Regulation 385-6.

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8. Operational Suitability.

a. Objectives.

(1) To determine the capability of the test item to aid detection, recognition, and identification of targets during periods of darkness or limited visibility.

(2) To determine the test item's capability to designate targets of interest to other sensor devices.

(3) To evaluate any ranging potential inherent to the device.

NOTE: For the purpose of this and the other subtests of these procedures, detection, recognition, and identification are defined as:

Detection: an indication of the presence of a target of military interest, but without recognition of the target.

Recognition: discrimination between targets as to the broad class, such as between tanks, trucks, and personnel.

Identification: discrimination between targets within a class, such as between two types of trucks, or between enemy and friendly personnel.

b. Method.

(1) Test soldiers should operate the test item during the hours of limited visibility and darkness to attempt to detect, recognize, identify, and to fix azimuth, elevation, and range to various moving and stationary targets. The targets will consist of personnel, vehicles, weapons, and other man-made objects of a military nature. Operations will be conducted under tactical conditions which will encompass the following as minimum requirements:

(a) The utilization of varying terrain, including open and flat, open and hilly, open with light undergrowth, sparsely wooded, and other terrain commensurate with the requirements of the specific item undergoing test.

(b) The test and control devices will be employed from tactically sound, surveyed positions when appropriate, and targets will be introduced randomly at surveyed positions which extend throughout the full range of the test item.

(c) Exercises conducted under conditions of darkness and reduced visibility which will include but not be limited to starlight, moonlight, and overcast.

(d) Exercises conducted during rain, haze, fog, or any other visibility-reducing act of nature available at the time of the test.

NOTE: When the test device has more than one mode of operation, such as passive/reflected illumination, passive/emitted radiation, or active supplementary illumination, all design modes will be tested under conditions as nearly identical as possible.

(e) Exercises conducted in conjunction with other sensor devices which require the type of assistance envisioned in the design (active) and potential of the test item to designate targets of tactical interest to other ground-based devices. As an example, a device with a target-designate beam will be directed on a target suitable for engagement by riflemen. A test soldier with a starlight scope mounted on a rifle will engage the target as the designate beam illuminates it.

(2) Tactical field exercises adaptable to the above requirements will be found in TOP 1-1-046, Field Combat Test Exercises.

c. Data Required.

(1) A record of the following for each exercise period of operation:

- (a) Type of terrain used.
- (b) Environmental conditions (weather and visibility).
- (c) Ambient light conditions.
- (d) Range(s) to targets.
- (e) Type targets (to include stationary or moving).
- (f) Mode of operation (active or passive).
- (g) Times and ranges at which detections occurred.
- (h) Times and ranges at which recognitions occurred.
- (i) Times and ranges at which identifications occurred.

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(j) Range estimations to targets (when testing range capability).

(k) Ease of mounting, dismounting, and adjusting the viewing position.

(l) Measurement of field of view.

(m) Minimum and maximum adjustments in elevation and deflection.

(n) Ease of operating controls.

(2) A record of the observations and operator comments on the ease or difficulty of adjustment during operation (to include comparing the test item's performance with control devices) in the following areas:

(a) Eyepiece.

(b) Reticle.

(c) Focusing.

(d) Mountings.

(e) Azimuth and elevation controls and indicators.

(f) Level indicators.

(g) Ancillary items.

(h) Ranging indicator.

d. Analytical Plan.

(1) Process the raw data obtained by:

(a) Marking test data for identification and correlation.

(b) Organizing data into tabular and/or graphic form.

(c) Modifying data to correct nonstandard conditions.

(d) Determining the statistical variation of the results in terms of the average value and standard deviation of the specific quantities, the correlation among two or more quantities, and the like. (This to be determined with the assistance of statistical personnel.)

(e) Converting the test data measurement units to compatible units expressed in the appropriate needs documents.

(f) Collating and reducing all data to a concise and workable form.

(2) Perform an appropriate analysis of:

(a) Comments and observations expressed.

(b) The collated data of significance to determine (1) the degree to which the test item meets the established criteria, and (2) whether the test device is equal, inferior, or superior to the control item.

(3) Present findings in a narrative supplemented with pictorial or graphic augmentation whenever appropriate.

9. Compatibility With Weapons Employment.

a. Objective.

To determine if the test observation device is suitable for employment with direct and indirect fire weapons as an aid to the adjustment of fires during periods of reduced visibility.

NOTE: This supporting test addresses Infantry weapons only. However, the same techniques and procedures used to test the device's compatibility with rifles, machine guns, recoilless rifles, and mortars may be adapted to tests associated with other major weapons such as tank guns and artillery pieces.

b. Method.

(1) Selected Infantry weapons will be fired during periods of reduced visibility during the day and during darkness to assess the capability of the test item as an instrument to aid in adjusting fire. The following are examples of employment:

(a) A test device operator, using the active mode illuminate beam, will provide illumination of the target for a 106-mm recoilless rifle gunner, who will employ a night sight as an aid to vision. The test device operator will sense the caliber .50 spotting rifle round and relay adjusting fire commands to the gunner until the strike of the spotter indicates a hit. Service ammunition will then be fired and accuracy data obtained.

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(b) A test operator, utilizing an active mode target designate beam, will designate the target to the 106-mm recoilless rifle gunner who will use a crew-served weapons sight to engage the target with his spotting rifle. The test device operator will sense the round and relay adjustments to the gunner who will withhold firing a service round of ammunition until adjustment is complete.

(c) A test device operator will adjust the fires of a machine gun crew during darkness by locating a target and giving an initial fire command to a crew which has no means of seeing the target. The initial fire command will include the range to the target in meters and a general direction to be fired. The machine gun crew will then fire single tracer rounds which are sensed and adjusted by the night observation device operator. Once the tracers are on target, the observation device operator will relay a command of "fire for effect" to the gunner who then fires a designated number of rounds at the target.

(d) An exercise to evaluate the adjustment of indirect fire will be accomplished by having a test device operator attempt to sense 81-mm mortar high explosive rounds as they are statically detonated in the vicinity of surveyed targets at points and ranges known only to the test officer. Each operator (observer) will use the reticle and range finder on the test device to sense a specified number of detonations, and will announce the location of each burst in relationship to the target in range and deflection. Each capability and mode of the specific device being tested will be examined by repeating the same process.

(2) In each of the above exercises, a comparison may be made by having the gun crews fire at the same targets, using standard limited visibility techniques to engage targets under varying light conditions. The results of such methods may then be compared to those obtained when using the test item.

c. Data Required.

(1) The following should be recorded for each exercise.

- (a) Terrain conditions.
- (b) Weather and visibility data.
- (c) Ambient light levels.
- (d) Range to target.
- (e) Type of target used.

- (f) Mode of operation (test device).
- (g) Weapon fired and type of ammunition used.
- (h) Method of fire adjustment.
- (i) Time for sensing and fire adjustment.
- (j) Time to first target hit.

(2) The following additional data for the weapons listed should also be recorded:

(a) Recoilless Rifle

- 1. Number of spotter rounds used in the exercises.
- 2. Time needed to engage target with spotter and service round.
- 3. Target(s) hit(s).
- 4. Mean time difference, test versus control devices.
- 5. Effectiveness (hits), test versus control devices.

(b) Machine Gun

- 1. Number of single round (tracers) required to reach target.
- 2. Number of fire commands used.
- 3. Mean times, "commence firing" to "fire for effect."
- 4. Target(s) hit(s).

(c) Mortar

Accuracy data for each operator/observer (expressed in average missed distances) when each sensing is compared to known locations as surveyed.

d. Analytical Plan.

(1) Process data obtained and reduce it to a workable form as directed by assisting statistical personnel.

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(2) Perform appropriate analysis of:

(a) Comments and observations of test personnel.

(b) The collated data of significance required to support a judgment of (1) the degree to which the test item meets established criteria, and (2) whether the test item equals, surpasses, or is inferior to the performance of the control item in the performance of equal tasks.

(3) Present findings in a narrative form supported by pictures and graphs when appropriate.

10. Suitability of Power Supply.

a. Objectives.

(1) To determine the suitability of the test device's power supply to provide power as required.

(2) To test the compatibility of the test item and its designated recharging apparatus or system.

(3) To compare the power supply capability with the requirements specified in the applicable needs documents.

b. Method.

Data to support a power supply evaluation will be collected throughout the conduct of all supporting tests. In particular, supporting tests which require multiple and sustained operation under tactical conditions (see supporting tests listed in Paragraphs 8 and 9) will provide adequate opportunity for appraisal. During the conduct of the exercises shown in Paragraphs 8 and 9, the test device should be subjected to:

(1) Continuous operation in excess of the maximum time specified in the appropriate needs directives, if possible (in both active and passive modes).

(2) Exposure to any secondary source of power authorized for use with the test observation device, i.e., standard battery, vehicle batteries.

(3) Periods of exposure to various authorized charging systems.

(4) Comparison with the control item in similar situations.

c. Data Required.

- (1) A record of the following:
 - (a) Time in operation (each time the device is activated).
 - (b) Accumulative operating time (each source of energy).
 - (c) Ease of starting or connecting after periods of inactivity.
 - (d) Time required to warm up (or cool down, if appropriate).
 - (e) Voltage output of each power supply, as monitored at the start, during, and following each activation (measured by standard voltmeter).
 - (f) Meteorological conditions.
 - (g) Compatibility of test item with each power source (primary, emergency, or ancillary).
 - (h) Time to accept charge from each power charger used.
 - (i) Down time, power failure.
 - (j) Comments and observations of personnel related to power supply and charging systems used.
 - (k) Data of comparison, test versus control devices, and test device versus criteria as expressed in materiel needs documents.

d. Analytical Plan.

- (1) Perform applicable analysis of:
 - (a) Comments and observations of personnel.
 - (b) Statistically oriented data, such as times and power readings.
 - (c) Data of comparison (test versus control), and test versus needs criteria).
- (2) Collate data and prepare a narrative report. Support the narrative with pictorial and/or graphic evidence, whenever appropriate.

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11. Portability/Transportability.

a. Objectives.

(1) To determine the degree to which the test device is man-portable and vehicle-transportable.

(2) To determine the ease of assembly, emplacement, and displacement from the carry to an operational-ready position.

b. Method.

The procedures of this supporting test will be conducted concurrently with other supporting tests to the maximum extent possible. The procedures will include as a minimum:

(1) The test device, in its man-pack configuration, will be tested by soldiers participating in various tactical exercises which will require hand-carrying, emplacement, and displacement. The test soldiers will be equipped with full TOE clothing and equipment and will carry fighting or existence loads, as appropriate. Depending on the characteristics of the specific test item, the test will include extensive movement and frequent displacement, displacement by a single soldier, or moves made by a number of soldiers acting as a crew. The terrain selected should be representative of the type normal to the employment of a night observation device, and the exercises will be performed both at night and during periods of limited daytime visibility.

(2) The test device will be transported, by appropriate tactical vehicles, over improved and unimproved roads, and cross-country. The test item will be transported in its carrying or shipping containers, its tactical carrying case(s), or any other appropriate cover(s). The normal transport time required for movement to and from the sites of other supporting tests will normally accumulate sufficient mileage for an accurate evaluation of transportability.

(3) An instrumented clothing and equipment test facility (CETF) is located at Fort Benning, Georgia. It is operated by the Infantry Board and provides excellent compatibility-with-tasks data. This instrumented CETF should be used if possible, but many of its stress-producing exercises are suitable for adaptation at other locales if access to the Benning facility is not feasible. (See Appendix B, TOP 1-1-046, Field Combat Test Exercises).

(4) Depending upon the size, weight, and/or configuration, a candidate device may lend itself to being carried by individual parachutists during airborne operations, to standard aerial delivery methods, or to internal or external air movement. The applicable

procedures of TOP 7-3-512, Airdrop; TOP 7-3-515, Air Portability, Internal; and TOP 7-3-516, Air Portability, External should be conducted to determine the degree to which the test item is air portable or transportable.

c. Data Required.

(1) A record of the following:

(a) Number of soldiers required to move the test device from place of carry to an emplacement position under tactical conditions.

(b) Distances moved, number of displacements, and time required for each move. (A move is defined as beginning with the test item in its carry position and ending when the test item is in position for tactical employment.)

(c) Time to assemble or set up the test item.

(d) Type of carrying provisions provided (straps, handles) and the relative comfort to the carrier afforded by each.

(e) Distance (in miles) test item is transported by type vehicle, type road, and type protective cover used.

(f) Results obtained at CETF (if facility is used).

(g) Comments and observations of personnel related to impressions gained throughout testing as related to portability and transportability.

d. Analytical Plan.

(1) Prepare an appropriate analysis of:

(a) The comments and observations collected.

(b) The time and distance data recorded.

(c) The comparative functional capabilities of the test versus control items.

(2) Collate all data and prepare a narrative report of results. Supplement the narrative with pictorial and/or graphic evidence, when appropriate.

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12. Security From Detection.

a. Conduct the appropriate procedures of TOP 3-3-515, Security From Detection, to determine the degree to which the test item is secure from sight or sound characteristics which might disclose its location to the enemy.

b. The type information required to support a security from detection evaluation will be obtained in other supporting tests where the observation device is subjected to tactical employment under conditions of a simulated combat environment. The supporting tests discussed in paragraph 8 and 9 afford excellent opportunity for concurrent data collections. If further data are required, additional exercises may be conducted to meet specific requirements.

c. A typical exercise will include:

(1) The test device, being employed to the extent of mode capability (active and/or passive), will be used in an attempt to detect, recognize, and identify various personnel and vehicular targets under conditions of starlight, moonlight, and reduced visibility conditions. Simultaneously, other test personnel, operating from locations normally accessible to an opposing force, will attempt to locate the observation device through sound or visual detection. Those personnel seeking the device will use whatever means they have available -- binoculars, metascope, starlight scope -- as aids to night vision.

(2) Particular attention will be directed toward detecting any light emissions emanating from luminous dials, scales, or other optical aids common to the device being tested. The distance at which noise produced by the operating test device can be heard, with or against the prevailing wind, will also be noted and recorded.

13. Electronic and Light Interference.

a. Objectives.

(1) To determine the extent of mutual interference resulting from the employment of the test device in proximity to other electronic and/or communications equipment.

(2) To determine the effectiveness of countermeasures utilizing visible and invisible radiation.

b. Method.

(1) Conduct the supporting test in accordance with the applicable sections of MTP/TOP 6-3-513, Qualitative Electromagnetic Interference.

(2) In performing the compatibility of operation tests indicated, the test device will be operated near to the type electronic and communications equipment normally found in an organization which will employ the observation device. For an Infantry-oriented device, this will include radio set AN/PRC-25; radio family AN/VRC-12; radar set, AN/PPS-5; and the instruments and communications equipment common to tactical vehicles, both air and ground.

(3) In addition, the test device will be operated against various visible light sources such as flashlights, vehicle headlights, searchlights, aerial flares, and illuminating rounds of ammunition to determine the effectiveness of visible light countermeasuring activities. Invisible light sources such as infrared weapons sights, metasopes, and light sources using infrared filters will also be addressed in the exercises of the referenced MTP/TOP.

c. Data Required.

In addition to the data required in the document referenced above, the following countermeasuring effect data will be assembled and recorded:

- (1) Source of visible and invisible countermeasure light.
- (2) Distance to light source.
- (3) Angle to light source.
- (4) Effects of the countermeasure experienced.

d. Analytical Plan.

As prescribed in MTP/TOP 6-3-513.

14. Durability.

a. Perform the appropriate procedures of MTP/TOP 6-3-506, Durability, to determine the ability of the test item to perform its intended functions satisfactorily for a specified period of time under specified operating conditions.

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b. Durability characteristics are determined during the course of a service test by conducting accelerated life testing and transport for a sufficient time to develop a test item history of deterioration, degradation, and maintenance. This history, together with the observations of test-item performance recorded by supervisory personnel, will be analyzed to determine the durability data required.

15. Reliability.

a. Objectives.

(1) To determine the degree to which the test-item will perform its intended function for a specified interval under stated conditions.

(2) To assess the degree to which the device meets the reliability criteria established in the appropriate materiel needs documents.

b. Method.

(1) Throughout the course of all supporting tests, note should be made of all malfunctions, equipment failures, and downtimes which interfere with the test item being available when needed.

NOTE: Any malfunction or loss of adjustment which renders a system inoperative or degrades system performance and cannot be corrected by operating personnel within time periods that do not jeopardize mission accomplishment will be considered a system failure. Likewise, any malfunction or loss of adjustment which can be corrected by operating personnel within the constraints but which is a recurring condition will be considered a failure.

(2) Reliability is usually measured in terms of equipment Mean-Time-Between-Failures (MTBF), which can be translated to a probability of success (or failure) if the statistical distribution of failure time is known or can be determined. Therefore, a reliability judgment may be obtained during the course of the expanded service test by a methodical and accurate accounting of those factors as defined and discussed in detail in MTP/TOP 6-2-503, Reliability. Although the reference procedure is directed toward engineering tests of electronic equipment, much of its methodology is appropriate to the conduct of the EST.

c. Data Required.

The following information should be recorded as it becomes available during the course of the EST:

- (1) Type of failure or malfunction.
- (2) Time and date of test item leaving service as result of failure.
- (3) Time and date of return of deadlined test item to full service.
- (4) Breakage or other evidences of defects leading to deadline status of test item.
- (5) Comments and observations of test participants pertinent to the reliability of the test device in relationship to standards, and when compared to the control item.

d. Analytical Plan.

Prepare an appropriate analysis to include:

- (1) Estimated achieved MTBF of the test item, with a confidence level and range, as applicable.
- (2) Graphic representation of the accept/reject criteria with failure-time data plotted to the decision point, and a decision statement, as applicable.

16. Maintainability.

a. Perform the pertinent procedures of MTP/TOP 6-3-524, Maintenance Evaluation to (1) determine the conformance to maintainability requirements of the test observation device as prescribed in the appropriate needs documents, and (2) determine the maintainability of the test item and the suitability of its maintenance package for use by the Army.

b. An ideal piece of equipment for the Army in the field should have an extremely low or nonexistent failure rate and be readily repairable at the prescribed level of maintenance when failure does occur. Realistically, Army equipment must not be out-of-service for an extended period of time nor require frequent high level maintenance and repair parts in order to keep it in operation.

c. The referenced MTP/TOP provides service test guidance for determining the maintainability of developmental equipment and the suitability of field maintenance provisions for the equipment so that corrective action may be taken to improve these, if required, prior to mass production and fielding. Data to support a maintainability judgment will be collated throughout the conduct of the EST.

17. Human Factors Engineering.

a. Conduct the appropriate procedures of MTP/TOP 6-3-525, Human Factors, to determine the adequacy of human factors engineering aspects of the test item, and its compatibility with the skills, aptitudes, and limitations of the personnel who will use it.

b. Data to support a judgment in this area will be obtained throughout the course of the EST. Results of observations, examinations, and measurements of specific design features, supplemented by the comments and observations of test personnel, will assist the test officer to arrive at a conclusion related to the test item's adaptability to use by the average soldier. Particular attention will be given to:

(1) The physical design to facilitate mounting, dismounting, and operating in darkness.

(2) The design of controls to facilitate identification and operation during darkness by personnel wearing various environmental clothing and equipment.

(3) The readability of indicators, dials, and control panels.

(4) The configuration and adjustability of the device to accommodate operation by the 5th through 95th percentile of the user population.

18. Value Analysis.

a. Objective.

To identify potential fruitful areas for subsequent value engineering by the developer.

b. Method.

Throughout testing, note will be taken of any unnecessary, costly, or nice-to-have features which might be modified or eliminated without compromising the effectiveness or safety of the test device.

c. Data Required.

Record the comments, observations, and reports of areas detected and identified as potential areas for an appropriate value engineering effort.

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d. Analytical Plan.

Analyze data collected and prepare a narrative recommendation for developer improvement in applicable areas. Support recommendations with pictorial or graphic supplements, when appropriate.

Recommended changes to this publication should be forwarded to Commanding General, US Army Test and Evaluation Command, ATTN: AMSTE-ME, Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from US Army Infantry Board, ATTN: STEBC-MO-M, Fort Benning, Georgia 31905. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No) printed on the first page.

APPENDIX
REFERENCES

1. AR 70-10, Research and Development, Test and Evaluation During Development and Acquisition of Materiel.
2. Military Standard 1472A, Human Engineering Design Criteria.
3. FM 31-36 (Test), Night Operations.
4. TECOM Regulation 70-24, Documenting Test Plans and Reports.
5. TECOM Regulation 70-34, Risk Analysis for Suitability Tests.
6. TECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
7. TECOM Regulation 700-1, Value Engineering.
8. TECOM Regulation 750-15, Maintenance Evaluation During Testing.
9. TOP 1-1-046, Field Combat Test Exercises.
10. MTP 3-1-002, Confidence Levels and Sample Sizes.
11. TOP 7-3-511, Airdrop Operations.

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) United States Army Infantry Board Fort Benning, Georgia 31905		2a. REPORT SECURITY CLASSIFICATION Unclassified	
		2b. GROUP NA	
3. REPORT TITLE US Army Test and Evaluation Command Expanded Service Test - System Test Operations Procedure "Night Observation Device."			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Final			
5. AUTHOR(S) (First name, middle initial, last name) Mr. Ray Rush			
6. REPORT DATE 21 September 1972		7a. TOTAL NO. OF PAGES 26	7b. NO. OF REFS 11
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S) TOP 6-3-097	
b. PROJECT NO.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
c. AMCR 310-6			
d.			
10. DISTRIBUTION STATEMENT Approved for public release; distribution unlimited.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Headquarters US Army Test and Evaluation Command Aberdeen Proving Ground, MD 21005	
13. ABSTRACT <p>Describes a method for evaluation of night observation device operational and functional performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for preoperational inspection, physical characteristics, personnel training, safety, operational suitability, compatibility with weapons employment, suitability of power supply, portability, transportability, security from detection, electronic and light interference, durability, reliability, maintainability, human factors, and value analysis. Applicable to short, medium, and long range night observation devices both active and passive operational modes. <u>Not applicable</u> to searchlights, sights, radar, sound ranging, detecting sets, photographic surveillance systems, periscopes, range finders, or other items which aid night operations.</p>			

DD FORM 1473

REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified

Security Classification

Unclassified

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Infrared Detection Devices Night Operations Optical Instruments Night Vision Optical Device Surveillance Equipment Target Location System Observation Device						

Unclassified

Security Classification